

**Patent Specification**



# PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### Improvements in Printing Cylinders

10 We, STANDARD PROCESS CORPORATION, a corporation organised and existing under the laws of the State of Delaware, United States of America, of 784, Mather Street, Chicago, State of Illinois, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to improved printing rolls or cylinders and more particularly to printing cylinders of novel formation to be utilised for 15 intaglio and typographical printing purposes.

Printing cylinders of the kind with which the present invention is concerned are used in rotogravure and similar 20 printing processes and for typographical printing. In use they are rotatably journaled in a printing press so as to bear on a sheet or web to transfer inked impressions thereon.

25 Prior to the present invention there have been three general types of printing cylinders having an external surface adapted to receive designs or other markings to be printed. These prior cylinders 30 when used for intaglio printing have an external copper printing surface in which a design is engraved or etched to receive the ink. In manufacturing the first of these types, a heavy solid copper cylinder 35 with a substantial wall thickness is formed and pressed on a tapered intaglio printing press mandrel by hydraulic pressure. The cylindrical interior of the copper is tapered to conform to the taper 40 of the mandrel on which it is to be fitted.

The second of the prior type of printing cylinders comprises a coating of copper applied to a steel or iron core by a special method of electro-deposition. 45 The thickness of electrolytically plated copper on these steel or iron cores in this second type of roll varies from one sixteenth to one eighth of an inch in thickness.

50 The third type of printing cylinder known for years prior to the printing cylinder disclosed and claimed herein comprises a seamless copper tube pressed

over an iron or steel core. This third type of printing cylinder of the prior art 55 is used only when cylinders of very large size are needed with economy as the main consideration and when the surface is to be photo-etched.

There are serious drawbacks to manufacturing the three prior types of printing cylinders briefly described above as well as numerous disadvantages attending their use.

60 In the first type of cylinder, where solid copper of substantial wall thickness is used and pressed onto a tapered mandrel, the solid copper shell is very expensive. Prior to the invention to be disclosed herein these were the only 65 standard rolls known to the textile trade. In providing these cylinders with a design to be printed they are either photo-etched, hand engraved, pantographed or milled with the desired design. After 70 the desired number of impressions have been made from the prepared surface of the roll, the design is turned or ground off and the surface of the roll is finished for another engraving. These turning, 75 polishing, etching and printing operations are repeated, continually reducing the circumference of the printing cylinder, so that the diameter of the roll becomes too small for further use, leaving in some cases more than one-half of the solid copper of the original roll that must be discarded, and which is worth 80 only the price of scrap copper. It will be seen that the initial cost of the prior art cylinder of the first type is high, and also that its useful life is short and that the roll is wasteful of expensive material.

85 A further disadvantage attending the use of the solid copper roll is that it very soon becomes distorted from its original cylindrical shape. This occurs as a result of repeatedly pressing the copper roll over the relatively hard steel mandrel, the inside diameter of the roll increasing with each pressing. After the inside diameter of the roll increases it will not stay securely in the same place on the mandrel requiring the use of 105 cloth liners or "shirts", as they are

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known to the trade, the cloth liners being wound around the mandrel to take up the increased inside diameter. With the terrific pressure applied by the hydraulic press it can readily be seen that the roll very soon gets out of true.

Another disadvantage encountered in using the solid copper roll is the existence on the surface of the roll of hard and soft spots. These hard and soft spots are the result of the many imperfections such as blowholes, etc., in the original ingot from which the roll is made by piercing the ingot and drawing it through a die. The hard and soft spots in the roll increase the difficulty of engraving the design on the roll and are particularly detrimental when the widely used photo-etching method is used to apply the design.

The second type of roll of the prior art which carries a plated layer of copper on its surface has one outstanding defect. If either hand engraving or milling of the design on the roll is used, the copper will come loose in spots from the roll. This is due to the actual stretching or moving of the plated copper covering by the constant tapping required in hand engraving, or the heavy pressure of the die used in milling. This is practically the only drawback to an electrolytically plated roll or cylinder.

The third type of prior art roll available for intaglio printing has so many disadvantages attached to its use that, as stated above, it has become almost obsolete except in the special case of photo-engraved rolls of large size. In the first place it is almost impossible to get a perfect metal to metal contact between the tube and the core by pressing the tube over the core and therefore there is a constant danger of the tube loosening from pressure. Again, it has the same imperfection as to the hard and soft spots, or lack of uniformity in the copper itself, as the first type of roll above described. It has also the one shortcoming of the second type of prior art roll, only to a greater extent, as the copper is not united to the core.

To sum up the disadvantages of these prior printing cylinders and the difficulties attending their use, they are expensive to produce, the printing surface in all except the second type is not uniform and only one, namely the first which is the most expensive and wasteful of the three can be used when the design is to be applied by hand engraving or milling. In some of these prior types of rolls is there any actual union between the copper and the base roll of iron or steel. In the second type of roll, namely

that provided with an electroplated layer of copper, the copper layer is merely adherent to the base and will loosen under the circumstances named above, and will also tend to loosen due to the difference in coefficients of expansion between the steel core and the plated copper. Because of the lack of union between the copper and the base roll, the cylinders of the prior art become distorted in use and will not give perfect printed images.

Accordingly, no printing cylinder has heretofore been available which can be used regardless of which process is to be employed in applying the design or marking to be printed and which can be produced and used in any desired size.

The present invention provides a printing cylinder in which the outer metallic layer having properties which make it especially suitable for intaglio or typographical printing is integrally and therefore inseparably united to the base or cylindrical backing of stronger and cheaper metal. Printing cylinders constructed in accordance with this invention do not have any of the disadvantages mentioned above and may be made in any size having any desired length and diameter. These improved cylinders surmount the difficulties mentioned above and have numerous advantages not to be found in typographical and intaglio printing cylinders of the prior art. The cost of a finished cylinder embodying this invention will be considerably below the cost of any of the three old types of roll of similar dimensions, and this improved cylinder despite its relatively low cost will be substantially perfect in every respect.

In addition to being applicable to the production of new printing cylinders, the present invention is also applicable to the renewal of worn or used cylinders, either of the improved types herein disclosed, or of the prior cylinders of the first type above mentioned.

Therefore it is a primary object of the present invention to provide a novel low cost and improved printing cylinder for use in intaglio and typographical printing processes, the improved cylinder comprising a base roll of ferrous or like relatively cheap metal having an integrally and permanently united layer of a metal having properties necessary for use in the particular printing process contemplated.

It is a further and more specific object of the present invention to provide a printing cylinder comprising a steel core and a layer of copper, copper alloy, zinc or other metals of any desired thickness autogenously united by a welding process to the steel core.

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Another object of the present invention is to provide a printing cylinder comprising a core of forged or cast steel or other suitable metal welded to an outer layer of copper, an alloy of copper, or other suitable metals.

Still another object of the present invention is to provide a textile printing roll comprising a copper layer autogenously united to a base roll of iron or steel.

It is still another object of the present invention to provide a printing cylinder comprising a backing roll having a wall of substantially uniform thickness and formed so that it may be mounted on the shaft of a printing press or like machine, the said backing roll having a cast external layer of copper or a copper alloy or the like autogenously united thereto.

Still another object of the present invention is to provide a typographical printing cylinder comprising a bronze, brass, zinc or like layer autogenously welded to a base roll of iron or steel.

Further objects of the invention will appear from the following detailed disclosure of illustrative embodiments thereof.

It has been proposed to provide working parts of machinery and the like with wear resisting surfaces by preparing those portions requiring such surfaces by amalgamating copper or cast iron therewith and depositing or casting thereon or welding thereto a surface of high speed metal. The copper or cast iron and the surface to be prepared were to be first brought to a molten state so as to amalgamate the copper or cast iron with the said surface and the high speed metal was then to be deposited in a layer on the surface so prepared, the high speed metal being brought to a molten state and the prepared surface being maintained in said state.

It has been proposed for printers and engravers trade, for example in calico and wall paper printing to cover plates and cylinders of iron or steel for example, by fusion, with aluminium or copper or their respective alloys, or tin, zinc, lead or their various alloys to heat the metals to be welded in contact in the presence of a reducing agent to a temperature sufficient to melt the covering metal (e.g. copper) but not sufficient to melt the iron or steel. It was stated that by this process the metals were firmly welded together and in many cases actual infiltration of the softer metal into the harder metal occurred.

The present invention consists in a method of producing or renewing a printing cylinder consisting of a metal base

roll or backing member and a layer of metal or alloy having properties suitable for providing a printing surface, which comprises autogenously uniting the base roll or backing member and the layer metal or alloy at the temperature of fusion of the base roll or backing member.

The present invention also consists in a method of producing or renewing a printing cylinder consisting of a metal base roll or backing member and a layer of metal or alloy which comprises autogenously uniting the base roll or backing member and a thin film of the layer metal or alloy at the temperature of fusion of the base roll or backing member.

The present invention also consists in a printing cylinder prepared or renewed by the method according to either of the preceding paragraphs.

Referring to the accompanying drawings:

Figure 1 is a sectional elevation through a form of printing cylinder embodying the present invention.

Figure 2 is an end view of the cylinder of Figure 1, the supporting shaft being omitted for the sake of clearness in illustration.

Figure 3 is a view similar to Figure 1 of another form of printing cylinder embodying the present invention.

Figure 4 is a sectional view taken along line 4-4 of Figure 3.

Only two embodiments have been chosen for the purpose of illustrating the present invention, but it is to be understood and will appear from the following complete disclosure of the invention that the following of the processes of welding herein stated enables the application of molten iron or steel within a shell of copper or an alloy of copper. Therefore the improved printing cylinder of the present invention can be provided in any kind or type desired.

In Figure 1, a base roll 9 of iron or steel is covered externally by a layer 11 of copper or other suitable metal. This layer 11 is applied in the manner herein-after stated so that it and the base roll 9 are integral. Reference character 12 indicates the weld which unites the dissimilar metals. To effect a proper weld between copper and like metals to steel or the like, the copper or the like should be heated to a considerable temperature above its melting point, and should be brought to the welding or fusion temperature of the steel. This weld provides a union which is equivalent to the union between pieces of iron or steel after they have been fused together by welding. The layer 11 remains in the

original properties, the change in the metal, if any, being confined to the thin film 18.

In applying the layer 11, it is preferred to cover the ends of the base roll 9 as shown at 14. By covering all of the outer surface of the roll 9, the latter is protected from the action of the acid used in photo-etching methods. The ends of the base roll 9 are also protected from rust and from attack by certain inks or dyes used in printing.

In order that the roll just described may be used in a printing press, it is shaped interiorly by forging or machining or a combination of these methods to fit a mandrel or arbor 15, the latter being of a type suited to the press to be used and forming no part of the present invention. The arbor 15 may be provided with a keyway 16 adjacent one end which receives a key 17 formed from the material of the base roll 9. A method of mounting a printing cylinder is fully disclosed in United States Patent No. 1,891,405, patented December 30, 1932 and following the mounting method disclosed therein, each interior end of the base roll is tapered as at 18 and correspondingly tapered split cones 19 are provided, said cones being slidably received on the arbor 15. One of the cones bears against a removable washer 20 seated in a groove in the arbor and the other cone seats against a tightening member comprising a ring 21 and a nut 22. The ring 21 bears against a second removable washer 20. It will be understood that any known or desired means may be used for mounting the base roll on a shaft or the like for use in a printing press.

In providing the base roll 9 with the autogenously welded layer 11, the layer may be cast about the roll, obtaining an intimate union between the base roll and the layer by fusion at their contacting surfaces.

The base roll 9 of iron or steel, which in its simplest and preferred form may be an iron or steel pipe, is prepared on its exterior surface by being cleaned thoroughly by any known method such as abrasive blasting if it is covered with scale and oxides. If desired, the roll may be cleaned by immersing it in an acid, preferably hydrochloric or hydrofluoric acid as these acids will form a protective coating of chloride or fluoride.

or a combination of abrasive and acid cleaning may be used. The chemically applied coating formed by acid pickling volatilizes readily when the molten coating metal is brought in contact with the base roll, exposing a clean metallic sur-

face to the action of the molten metal, facilitating the welding.

After cleaning, the base roll is preferably heated almost to the fusing point of the metal. The copper, copper alloy or other layer metal, if it is to be applied to the roll in a molten condition, should also be heated to a temperature equal to or slightly greater than the fusing temperature of the base roll, which temperature is considerably above the melting point of copper, and maintained at that temperature during the weld coating operation. The heated base roll is centered in a mold into which is poured the highly heated coating metal. The preliminary heating of the base roll is done to avoid abstraction of heat from the highly heated coating metal and to bring its surface momentarily to the fusing temperature when the highly heated layer metal contacts therewith.

In this welding step, the mould is heated to substantially the same temperature as the molten welding metal and pouring of the welding metal into the mould is done under vacuum, insuring no oxidation and no blowholes or imperfections of any kind in the outer layer caused from possible gases.

After the base roll is heated and before the covering metal is poured, it may be kept in a neutral atmosphere. In the mould to avoid possible oxidation previous to pouring, the arrangement used to apply suction to the mould during pouring being used to supply a neutral gas, the supply of which can be cut off when vacuum is substituted. If desired the pouring may be effected in a neutral atmosphere without the use of vacuum. Any suitable method of preventing undesirable oxidation of the heated roll and metal may be utilized during the pouring of the metal. Preferably the mold and roll are heated together.

Copper alloys, such as brass or bronze, may be readily united directly with the base roll by the above described cast welding process if the surface of the base roll is first fumed with the vapours of tin, zinc or a like metal having a low fusing point and capable of readily uniting with steel or iron. The low melting metal used in fuming the surface of the iron or steel of the base roll does not form a coating thereon of appreciable thickness but the vapours combine with the metal at the surface of the base roll thereby producing a superficial alloying of a particular type and also heating the surface of the roll to a comparatively high temperature. The metallic vapours prevent oxidation of the base roll. After the base roll is prepared by subjecting it to

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to the metallic vapours, it is centered in a mold and the brass, bronze or other metal poured around it as above set forth. The cast brass or bronze shell and the

5 base roll are integral.  
Another and preferred method is first to weld a thin film of the coating metal, or a metal with which the base metal and the coating metal will readily combine, 10 onto the base roll, and thereafter to cast an outer layer or jacket of the layer metal against the film of metal on the base roll. This permits the casting of the balance of the outer layer at the 15 proper casting temperature of the copper or other layer of metal giving an improved outer layer. The outer layer of metal as it is cast will integrally unite with the film of metal so that the base 20 roll, the welded film and the cast outer layer are one integral piece.

In applying the welded film, the base roll is first heated, preferably out of contact with the atmosphere and if 25 desired in the presence of a neutral gas, and is immersed in a bath of the highly heated coating metal where it is allowed to remain for a short time. Upon removal it will be covered with a thin 30 layer or film of the coating metal intimately united thereto. The film welded roll is next centered in a mold, the roll and mold preferably being heated approximately to the melting point of 35 the layer metal to be cast thereon, and a layer of suitable metal heated to its melting point, such as copper, zinc or the like, or an alloy such as brass, bronze or the like which will combine therewith is cast against the welded film, the cast 40 layer uniting integrally therewith. Between the dipping and casting operations, the film coated roll is preferably kept in a neutral atmosphere or otherwise pre- 45 vented from oxidizing. This may be done by filling the mold with a neutral gas and placing the roll in the bath immediately after immersion in the bath of highly heated molten metal.

By first providing a welded coating of copper in the manner just described, brass, bronze, zinc or the like can be cast against the copper film, the molten 50 brass, bronze or zinc combining readily with the copper film at ordinary casting temperatures of the brass, bronze or zinc. Instead of building up the film welded metal roll after dipping by casting the added metal thereon, the additional 60 metal desired may be electrolytically deposited on the film welded layer, providing a high grade uniform coating layer of electrolyte copper or other metal integrally united to the base roll, a 65 desirable combination that it has not

been heretofore possible to produce.

According to another method, a self supporting shell may be provided, united to the base roll by fusion, or the base roll may be cast within the shell 70 using means known in the moulding art for shaping the roll as it is cast, or in a manner now to be described.

The integral multi-metallic printing cylinder of the present invention may be 75 produced by casting the iron or steel core within an outer cylinder of solid copper of a thickness corresponding to the required thickness of copper jacket in the finished roll. In casting the base roll 80 in this manner, it may be molded internally by providing a core in the mold in accordance with molding practices known to those skilled in the moulding art, so that but very little machine finishing 85 will be needed to prepare the interior of the base roll for mounting on a shaft or arbor, such for example as the arbor of Figure 1.

In producing a printing cylinder 90 having a molded base roll, the outer shell or jacket of copper or an alloy of copper is placed in a mold having a cylindrical interior with which the shell or jacket 95 contacts. The inner periphery of the shell against which the base roll is to be cast is coated with a protective paint containing a powdered purifying metal such as aluminum. The molten iron or steel 100 which is to form the cast base roll is next poured into the mold and as it rises in the mold it melts off the protective coating of paint and contacts with the clean metallic surface of the jacket. The molten metal causes fusion of the sur- 105 face against which it is cast and the cast inner base roll and the outer jacket are joined by a weld.

It will be seen from the foregoing that by the present invention, printing cylinders of any size may be provided, and in use, it is impossible for the layer metal to become separated from the base roll at any stage of the printing process in which the improved printing cylinders 115 may be used, either due to differences in expansion rates of the metals or the temperatures vary, or during subsequent operations of preparing the cylinder for the reception of new designs or markings 120 to be printed whether such designs or markings are formed by photo-stocking, pantographing or hand engraving or other processes which are employed in preparing printing cylinders for intaglio 125 printing.

A printing roll having an integral outer covering of brass or bronze is specially suitable for use in typographical printing processes. An integral copper 130

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covered printing roll produced in any of the manners described above is also suitable for typographical printing and its value is further enhanced for this purpose by being chrome-plated after etching.

- In providing the improved welded printing cylinders for use in the printing arts, it is contemplated to produce the cylinders with a layer having sufficient thickness to provide material for several etched or engraved designs. After a design has served its purpose, the surface of the layer is ground and polished to receive a new design. After the cylinder has been used for printing successive designs until practically all of the material of the jacket has been ground away, the cylinder can be readily and cheaply renewed by casting new metal against the metal of the layer which remains on the cylinder in the manner above set forth for applying metal to the film coated rolls. This method of renewing used or worn rolls by welding a layer of metal thereto may also be applied to the heretofore mentioned prior type. It will also be understood that to avoid reduction in diameter and circumference of the improved printing cylinder, it may be plated with new material deposited electrolytically after the first design has been removed. When used in this way the improved printing cylinder will always have substantially the same circumference and as its useful life is of indefinite duration it can be used for printing an indefinite number of designs without change in shape.

Figures 3 and 4 of the drawing illustrate another embodiment of the improved roll of the present invention. Referring to these figures in detail, it will be seen that the principal difference between the roll in Figures 1 and 3 resides in the uniform thickness of the wall of the base roll 9. The base roll or cylinder 9 is formed with a wall of substantially uniform thickness throughout its length, the conical surfaces 16 adjacent the ends of the roll being provided by decreasing the diameter of the roll for a short distance adjacent each end as indicated by reference numeral 23. The key 17, which is received within a keyway in a shaft or arbor similar to the shaft or arbor 15 of Figure 1, is formed from the material of the base roll 9 at its section of reduced diameter. This base roll may be economically formed from standard steel pipe by forging without the necessity of upsetting of the metal required in

the roll construction of Figure 1.

It is impossible, in printing cylinders known to the prior art, for the base roll to have the structure described above in connection with Figures 3 and 4 of the drawing. In fact, the peripheral surface of printing cylinder base rolls heretofore produced must be cylindrical as the printing surface is applied by electroplating and derives its external shape from the shape of the base roll. By cast welding the external jacket to the base roll, the outer surface of the base roll can have substantially any configuration resulting from the methods and means employed in the manufacture of the base roll.

The layer 11 of metal is permanently welded to the base roll 9 by any of the methods set out above and covers the ends of the base roll at 14. It will be noted that the thickness of the layer varies because of axial variations in the diameter of the base roll and is greatest at the reduced sections 23 of the base roll.

From the foregoing complete disclosure of the present invention, it will be apparent that the improved printing cylinder provided thereby is capable of being economically produced, has a useful life greater than that of any type of printing cylinder known to the prior art and may be used to replace or reconstruct the prior art cylinders.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of producing or renewing a printing cylinder consisting of a metal base roll or backing member and a layer of metal or alloy (hereinafter referred to simply as "layer metal") having properties suitable for providing a printing surface, which comprises autogenously uniting the base roll or backing member and the layer metal at the temperature of fusion of the base roll or backing member.

2. A method of producing or renewing 130

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a printing cylinder consisting of a metal base roll or backing member and a layer of metal or alloy (hereinafter referred to simply as "layer metal"), which comprises autogenously uniting the base roll or backing member and a thin film of the layer metal at the temperature of fusion of the base roll or backing member.

3. A method as claimed in claim 1, comprising casting the layer metal about the base roll or backing member at the said temperature.

4. A method as claimed in claim 3, wherein the base roll or backing member is first fumed with the vapour of a protective metal such as tin, zinc and the like.

5. A method as claimed in claim 2, comprising the subsequent step of casting on an outer layer of the layer metal said outer layer having properties suitable for providing a printing surface.

6. A method as claimed in claim 2, comprising the subsequent step of forming by electrodeposition an outer layer having properties suitable for providing a printing surface.

7. A method as claimed in claim 1, comprising uniting the base roll or backing member and a shell of the layer metal by fusion at the said temperature.

8. A method as claimed in claim 1, comprising casting the base roll or backing member within a shell of the layer metal.

9. A method as claimed in claim 8 wherein the inner surface of the shell is

first coated with a protective paint, containing aluminium for example.

10. A method as claimed in any of the preceding claims, wherein the base roll or backing member comprises iron or steel.

11. A method as claimed in any of the preceding claims, wherein the layer metal comprises copper, zinc, or a copper alloy such as brass or bronze, or the like.

12. The various methods of producing or renewing a printing cylinder substantially as described with reference to the 50 accompanying drawings.

13. A printing cylinder prepared or renewed by the method claimed in any of the preceding claims.

14. A printing cylinder as claimed in 55 claim 13, in which the base roll is of ferrous metal of generally tubular shape and formed with a wall of substantially uniform thickness, the internal bore of said base roll varying in diameter to provide mounting means whereby said roll may be secured on a shaft, and in which said layer of metal has a cylindrical outer surface.

15. A printing cylinder as claimed in 65 claim 14, in which the backing member is a hollow steel base roll formed to be clamped upon the shaft for a printing press, and the layer of metal is formed of cast copper autogenously united to said base roll, together with a printing surface formed on said layer of copper.

Dated this 28th day of June, 1935.

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[This Drawing is a reproduction of the Original on a reduced scale.]

